laboratory in which the ammeters and voltmeters are calibrated, we find some very important points about the D'Arsonval galvanometer. Numerous attempts have been made to use this form of galvanometer as direct-reading ammeters and voltmeters, but the employment of permanent magnets makes their instrument one of only a very limited degree of permanent accuracy. The same principle is employed by Sir William Thomson in his siphon recorder; and Messrs. Deprez and D'Arsonval, and many others, have tried to make commercial and portable instruments, as well as delicate laboratory instruments. All these instruments have the same defect, that their sensibility diminishes as the magnets grow weaker. Besides this serious trouble, further investigations have shown, that, in spite of the very small angles through which the coil moves, the deflections will not be proportional to the current. Ayrton describes this as follows: "If you start from the centre, so that the spot of light is at one extreme end of the scale for no current, you find, on carefully calibrating the instrument, that you get a broken line consisting of two straight lines meeting at an angle, or probably, strictly, meeting according to some curve at about the spot corresponding with the plane of the coil, being parallel to the lines of force. Hence there is a difficulty in dividing the scale uniformly; and this difficulty is met with even when the plan of using curved pole-pieces is adopted, as proposed by us some six years ago."

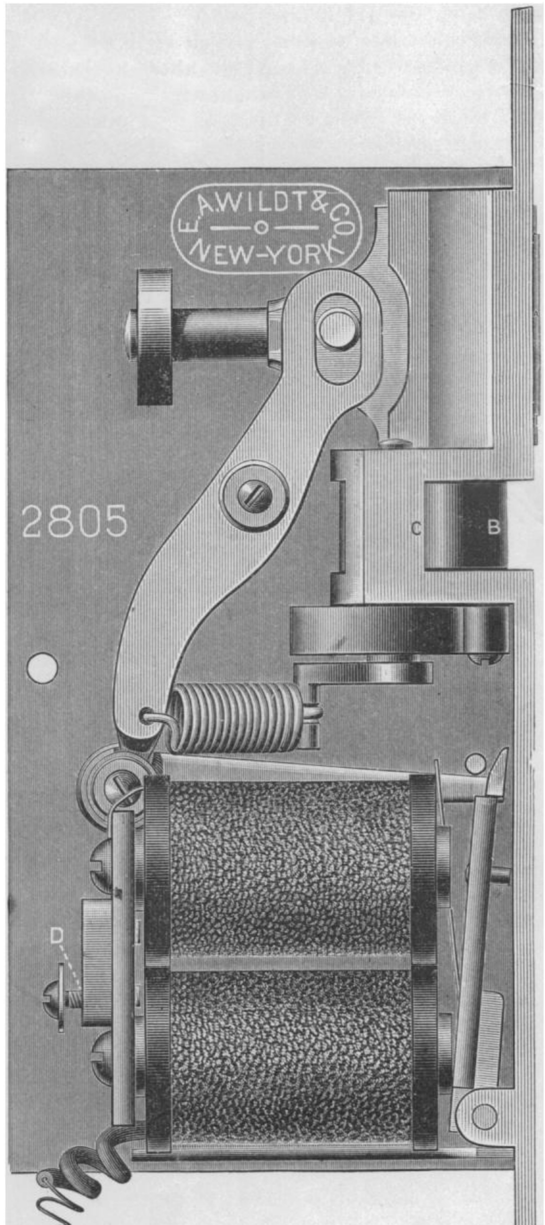
The most interesting instrument, however, brought out and perfected by Professors Ayrton and Perry, is the new direct-reading hot-wire volt- and ammeter. The underlying principle is that which is used by Cardew in his voltmeters,— that the passage of a current will heat a wire, and thereby lengthen it. Ayrton and Perry had an excellent means in their patent springs of multiplying the minute changes of the dimensions; and the employment of this very spring reduces the Cardew of three feet length and four yards of fine wire to one in which eight inches of wire are sufficient to indicate differences of potential of less than $\frac{1}{100}$ of a volt. The above figure shows a cross-section of the instrument as at present constructed. The combined pull of the spring M and of the platinum silver wire WW, attached to the blocks B, B, is counterbalanced by the pull of the spring S. Hence, as the wire stretches, the magnifying spring M is stretched, and the point P, to which a number of fine hairs are attached to introduce damping without solid friction, rotates. The flat spring is not only introduced to enable the depth of the instrument to be diminished by twice the sag of the wire, but to enable a particular arrangement of fuse to be employed.

The fuse F is of such a diameter that it would require a far larger current to melt it than would damage the instrument. In addition, a platinum-tipped screw, D, is arranged so that when the wire WW stretches by any pre-arranged percentage beyond the amount it stretches for the maximum safe potential difference, the platinum tip C, of the flat spring S, comes into contact with the screw D, and the working wire is short-circuited. The circuit is then temporarily completed through the lead L, to the left of the flat spring S, and the fuse F, when the current increases and the fuse melts without damage to the instrument. With this device, they find that the fuse may be thick, and therefore have but a small resistance compared with that of the working wire, and yet the sudden application of a potential difference five or six times as great as the maximum potential difference the voltmeter is intended to measure, melts the fuse without damaging the working wires. For clearness, the fuse, the key, and the terminals V, V, are shown detached from the instrument, but they are in reality in the base, as seen in Fig. 1.

AN ELECTRIC DOOR-OPENER.

AN improved electric door-opener, manufactured by Wendt & Co., of this city, is shown in the accompanying illustration. It requires but small battery power. The wires are concealed from view; and a slight pressure on the ordinary electrical push-button not only releases the latch, but causes the door to be thrown open. The closing of the door resets the opener automatically.

The mechanism of the door-opener is simple. B is a throw-back, which swings on a pivot to which is attached the inner end of a coiled flat spring. To a crank on the end of the pivot, outside the coiled spring, is attached a spiral spring. The closing of the door swings the throw-back around on its pivot, thereby compressing the coiled spring, which is of sufficient strength to force open a heavy door when released. The spring is prevented from acting until the armature, which is pivoted at the lower right-hand corner of the opener, is attracted by the electro-magnet. The movement of the armature allows free movement to a tongue pivoted to the up-



ELECTRIC DOOR-OPENER.

per left-hand corner of the electro-magnet, against which the latch-bolt lever bears. The action of the opener is as follows: When the circuit is closed by a touch on the button, the armature is attracted by the electro-magnet; the tongue moves, thereby releasing the spiral spring, which pulls back the latch-bolt; and at the same time the coiled spring forces the door open by means of the throw-back.

THOMAS WHITTAKER has just published "The Washington Centennial Souvenir," — a large, finely printed, and handsomely illustrated brochure arranged by Frederick Saunders of the Astor Library.